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QUALITY EVALUATION OF BIOCHAR FROM DIFFERENT AGRICULTURAL BIOMASS

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ABSTRACT

Biochar, one of the co products of pyrolysis unit , is a potential soil amendment that sequestrates large amount of carbon which helps in increasing the soil fertility. And also application of biochar to t he soil reduces compaction, increase water holding capacity, nutrient availability, enhance biological activity, increase crop yields and reduce nitrous oxide emissions. In this research, bhendi and brinjal stalks are used to produce biochar by using pyrolysis. The nutritive content in biochar is analysed by proximate and ultimate analysis. As the result of proximate analysis, the nutritive contents such as moisture content, ash content, fixed carbon and volatile matter has recorded higher in bhendi stalks whereas in ultimate analysis such as carbon, nitrogen, hydrogen and sulfur, brinjal stalks has recorded a higher value. As the result, applications of biochars of bhendi stalks and brinjal stalks will improves the soil nutritive content than the biomass application

KEYWORDS: *Biochar, bhendi, brinjal, proximate analysis, ultimate analysis, soil fertility.*

I.INTRODUCTION

The world‘s population is expected to reach 9 billion by 2050 which will require an increase of >50% in agricultural food supply to meet the growing demand. Over the same period, climate change, water scarcity and land degradation are expected to negatively impact agricultural productivity, which may severely challenge our ability to meet this required demand of food production. People that are already poor and vulnerable may be the worst affected, despite having contributed least to climate change. Since the global challenges of hunger, nutrition and climate justice are strongly connected it is critical to minimize further land use change, land degradation and greenhouse gas (GHG) emissions.

The complex interrelationship of agricultural production, water availability, and soil health will underpin the possibilities for achieving the Sustainable Development Goals of the United Nations Sustainable Development Solutions Network (Sustainable Development Solutions Network 2015). Managing land degradation is a central challenge that simultaneously addresses environmental and development objectives. The literature often reports that the majority of land degradation is caused by human activity (e.g., overgrazing, deforestation, agricultural mismanagement or mining) that stimulates the loss of organic matter due to erosion, physical and chemical soil deterioration of the soil. This in turn reduces soil productivity and the provision of crucial ecosystem services. Moreover, agriculture is one of the major GHG emitters (i.e. CO2, CH4, N2O) accelerating global warming (IPCC 2013, 2000), which almost certainly will negatively impact agriculture. This contribution will even be enhanced with future climate change by positive feedback effects of elevated CO2 on non-CO2 GHG formation, rising temperatures and more extreme weather events, such as droughts and flooding. Thus, agricultural management requires adaptation and mitigation strategies to reduce GHG emissions while simultaneously increasing crop productivity. One adaptation strategy is to apply organic matter to agricultural lands.

Application of organic matter has shown to improve the properties of soils and agricultural productivity. However, soil organic matter can decompose quickly, necessitating repeated applications. Thus, the usage of stable compounds such as biochar as soil amendments, or as part of organic amendments such as compost or manure, may be a cost-effective and low-risk alternative to improve agricultural productivity and to mitigate climate change over the long-term (Khalid Mehmood *et al.*, 2017). Biochar, the solid product of biomass pyrolysis, has been produced and utilized for several thousand years and is best known as charcoal (when produced from woody biomass). The applications of biochar are very diverse, ranging from heat and power production, flue gas cleaning, metallurgical applications, use in agriculture and animal husbandry, building material, to medical use.

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Effect of biochar composite and organic sources on soil properties and yield of bhendi attributed to increased nutrient availability, cation exchange capacity and water holding capacity of soil by the addition of biochar. In India, prosopis was introduced in the late 1900‘s to meet the fuel requirement of the rural poor. It is a phreatotype plant widely distributed in India and has survived where other tree species fail to grow and become a nuisance to the environment. It inhibits the germination of other species seeds that present in its vicinity. It has a negative impact on native vegetation and interferes with water supply, hydrological functioning and herbivores grazing potential. Complete eradication was inevitable but we can reduce the menace of prosopis by converting them into agriculturally important carbon rich biochar. Therefore, in this study prosopis based biochar was prepared and biochar composite was prepared to study the effect of biochar and inorganic fertilizers on soil nutrient availability, carbon status and yield of bhendi crop.

With this, the study focused on the Quality evalution of bichar from different agricultural biomasses. The main is to analyze the nutrient content of biochar.here is important to select a biomass which is rich in carbon and porous constant. It is very much important to analyse this kind nutrient because the biochar used as a fertilizer and also act as substitute for soil which promote the growth of plants and high in water holding capacity.

II.METHODOLOGY

The preparation of biochar carried out in many other ways. Here, we used pyrolysis method to produce the biochar.pyrolysis is the best way to produce high quality of biochar through slow pyrolysis,which is combustion of selected biomass at 300ºC and below the requirement of time is much longer and also maintain in same temperature the biochar get ready after the temperature is completely reduced upto room temperature. The selection of raw material is based 0n nutrient. Here, we select agriculture waste that is after cultivation, the harvesting of Bhendi,brinjal,coconut petiole collected from the village and after that the selected samples are dried for 3 days after the samples are completely dried weighed each 10kg. The processed raw material procured from the village to our institution and the samples are directly converted into biochar by our pyrolysis unit.The pyrolysis unit was 1kg each top and bottom layer, the separation of this champers is to carry top as sample and bottom as charcoal. Here, the pyrolysis unit carried out by slow pyrolysis method for production of biochar. First the selected samples weighed for 1kg each and keep it apart.

The main principle of pyrolysis is to combustion of biomass without oxygen, Here, the charcoal is selected as a combustion material, the charcoal also weighed 0.75kg and pre-heated until it turns to 300ºC nearly and immediately put it in to the lower champer of the pyrolysis unit after that without any delay the weighed sample filled in upper chamber and then the upper was closed using chimney with the help of chimney, the pre-heated charcoal turns to initial the combustion process it is only for initial action of biochar preparation. Here, we took nearly 30mins for the required capacity. After 30mins the chimney was removed and immediately the air tight lid was closed both top and bottom of the chamber. Here, or at this stage the process of pyrolysis starts. The slow combustion of stalks were initiate to turns as biochar, the required 1kg of sample tooks 3hrs to complete the process and it is important that the lid opened after the complete set up turns to room temperature because a little amount of oxygen turns the material as ash.After 3hrs the processed biochar collected from the pyrolysis unit and repeat the same process for another two sample. Once the process was over the collected biochar were powered to easy the quality analysis.

FIGURE 1 REPRESENTS THE PREPARATION OF BIOCHAR

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III. DISCUSSION

The Moisture content, ash content, fixed carbon and volatile matter are measured by the proximate analysis method. The carbon, hydrogen, nitrogen, sulphur are measured by the ultimate analysis method.

TABLE 1
Proximate Analysis of Biochar

Parameters	Biochar (wt %) dry basis	
	Bhendi Stalks	Brinjal Stalks
Moisture	3.6	3.1
Ash	4.75	4.28
Fixed Carbon	61	42
Volatile Matter	6.5	5.8

The fixed carbon is more in Bhendi stalks. The Brinjal stalks have the lower all four required contents. The proximate analysis of biochar derived from bhendi (okra) stalks and brinjal (eggplant) stalks reveals distinct characteristics that can influence its application and effectiveness as a soil amendment or carbon sequestration material.The moisture content of both biochars is relatively low, with bhendi stalks showing 3.6% and brinjal stalks at 3.1%. Low moisture content is favorable as it indicates higher stability and durability of the biochar during storage and application. This characteristic enhances its potential for long-term carbon storage in soil.The ash content for bhendi stalks is 4.75%, slightly higher than that of brinjal stalks at 4.28%. Ash content is an important factor as it reflects the mineral composition of the biochar, which can influence soil fertility. The presence of minerals can improve soil nutrient levels, while the slight difference in ash content suggests that biochar from bhendi stalks might provide a marginally higher mineral supply compared to brinjal stalks.Fixed carbon content is crucial as it represents the stable carbon fraction of biochar. Bhendi stalks exhibit significantly higher fixed carbon content at 61%, compared to 42% for brinjal stalks. This difference suggests that biochar from bhendi stalks may be more effective for carbon sequestration and may contribute to improved soil structure and stability over time.The volatile matter content for bhendi stalks is 6.5%, while brinjal stalks have a slightly lower value of 5.8%. Higher volatile matter can indicate a greater potential for gas emissions during the application or degradation of biochar. However, the overall low levels of volatile matter in both samples suggest that they are stable and less likely to emit harmful gases post-application.

TABLE 2
Ultimate Analysis of Biochar

Parameters	Biochar (wt %) dry basis	
	Bhendi Stalks	Brinjal Stalks
Nitrogen	1.81	1.82
Carbon	59.06	71.40
Sulfur	0.71	0.05
Hydrogen	0.93	1.22

The nitrogen and carbon content are higher in brinjal stalks. The sulphur content is higher in bhendi stalks. The elemental analysis of biochar derived from bhendi (okra) stalks and brinjal (eggplant) stalks highlights significant differences in their chemical composition, which can influence their utility in agricultural practices.The nitrogen content is comparable in both biochars, with bhendi stalks at 1.81% and brinjal stalks at 1.82%. Nitrogen is an essential nutrient for plant growth, and both biochars can provide a moderate source of nitrogen. The similar levels suggest that both types of biochar can contribute to soil fertility, although further studies on the bioavailability of this nitrogen are needed.The carbon content reveals a notable difference: bhendi stalks contain 59.06% carbon, while brinjal stalks have a significantly higher carbon content of 71.40%. This higher carbon level in brinjal biochar indicates a greater potential for carbon sequestration. The increased carbon can also enhance soil structure, improve moisture retention, and provide a long-term energy source for soil microorganisms.Sulfur content is another area of difference. Bhendi stalks have a sulfur content of 0.71%, which is substantially higher than the 0.05% found in brinjal stalks. Sulfur is critical for plant metabolism and can influence the synthesis of amino acids and proteins. The higher sulfur content in bhendi biochar may provide an added nutritional benefit for crops grown in soils amended with it.The hydrogen content is higher in brinjal stalks (1.22%) compared to bhendi stalks (0.93%). Hydrogen, while not a primary nutrient, is important in forming organic compounds in the soil. The higher hydrogen content in brinjal biochar could suggest a greater potential for enhancing microbial activity, which relies on organic matter breakdown and nutrient cycling.

IV.CONCLUSION

Biochar from bhendi stalks, brinjal stalks and coconut petiole are produced by pyrolysis method. By using the dry biomass of bhendi stalks, brinjal stalks and coconut petiole directly to the soil will improve the soil nutritive content. Whereas using biochars of bhendi stalks brinjal stalks and coconut petiole to the soil also helps more and improves the soil nutritive content. But the improvement of nutritive content of biochar application is more than the biomass application. The proximate analysis indicates that biochar derived from bhendi stalks has superior characteristics compared to that from brinjal stalks, particularly in terms of fixed carbon content. These properties suggest that

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bhendi biochar could be more beneficial for applications aimed at enhancing soil fertility and promoting carbon sequestration. Further studies could focus on the long-term effects of these biochars on soil health and crop yield to validate their practical applications in agriculture. This is because of the nutritive content present in biomass increased when it is converted into biochar. Thus the nutritive content in biochar is analysed by proximate and ultimate analysis.As the result of proximate analysis, the nutritive contents such as moisture content, ash content, fixed carbon and volatile matter has recorded higher in bhendi stalks whereas in ultimate analysis such as carbon, nitrogen, hydrogen and sulfur, brinjal stalks has recorded a higher value. As the result, applications of biochars of bhendi stalks and brinjal stalks will improves the soil nutritive content than the biomass application. The elemental analysis indicates that while both bhendi and brinjal biochars can enhance soil fertility, they possess distinct characteristics that may cater to different agricultural needs. The higher carbon content in brinjal biochar positions it favorably for carbon sequestration, while the increased sulfur in bhendi biochar could enhance its role in providing essential nutrients. Further research should explore the specific impacts of these biochars on plant growth and soil health to optimize their application in sustainable agricultural practices.

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